

The History of the Yellow Fever mosquito, *Aedes aegypti*, and Human Disease Epidemics: Implications for Modern Preparedness and Public Health

**Missouri  
State**<sup>TM</sup>

**MASTER** *of*  
**PUBLIC HEALTH**

David Claborn, DrPH

CDR USN (ret.)

Interim Director

Master of Public Health Program

Missouri State University

# Outline

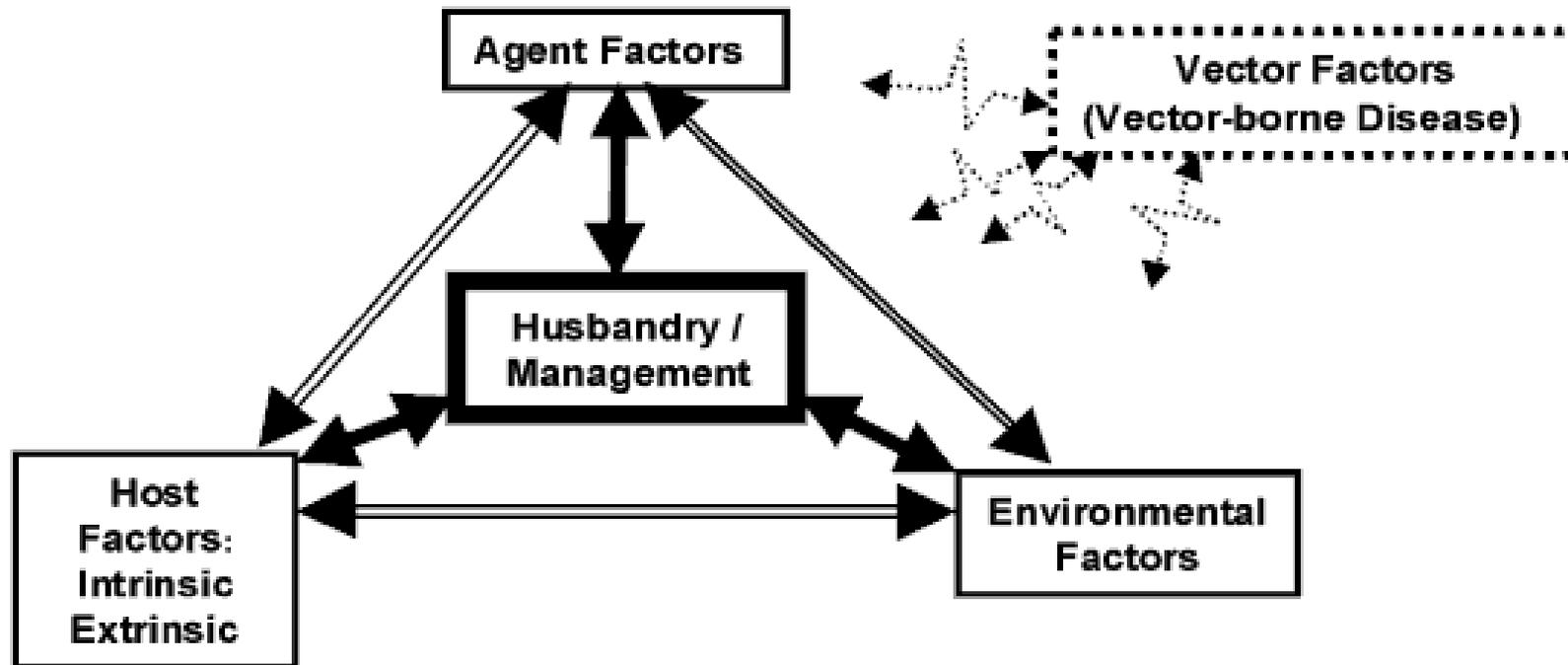
- 1. What is the 'yellow fever mosquito'?
- 2. Why are people today concerned about it? Is it causing an "emergency"?
- 3. Does it occur in the U.S.? In Missouri?
- 4. Should something be done about it? If so, what?

# Medical entomology 101 (in 3 minutes)

- There are over 3200 species of mosquitoes; most do not spread disease to humans.
- Vectors are insects and related animals that pick up a disease agent (virus, bacterium, round worm), perhaps help the agent to reproduce, then transmit it to a host (human?) through a bite.
- Vector-borne disease include typhus, bubonic plague, Lyme disease (body louse, rat flea and tick, respective vectors)
- Mosquitoes are most important vectors primarily due to malaria, but other mosquito-borne diseases include dengue, yellow fever, Japanese encephalitis, WEE, VEE, SLE, and hundreds of other, esp. viruses.
- One particularly important vector outside the malaria world is the yellow fever mosquito, *Aedes aegypti*.

# Overview of vectors and disease as part of the epidemiologic triad

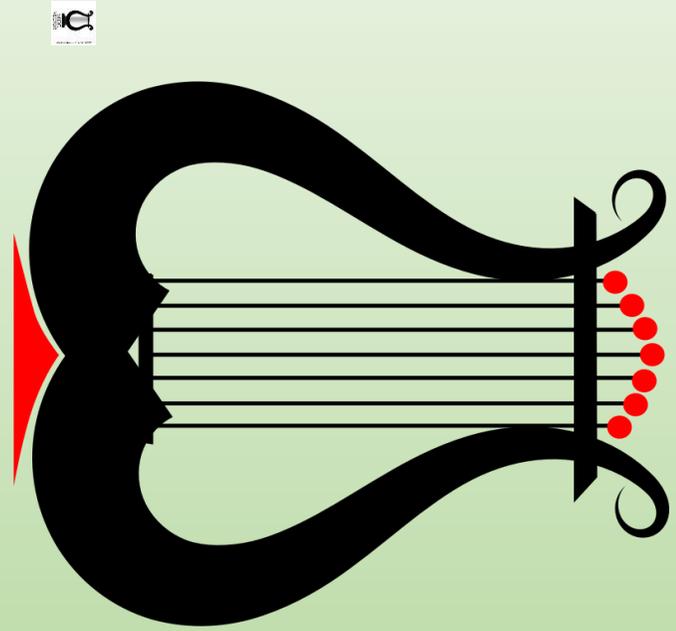
## The Epidemiologic Triad



The components of medical ecology

# The villainess





*Aedes aegypti*

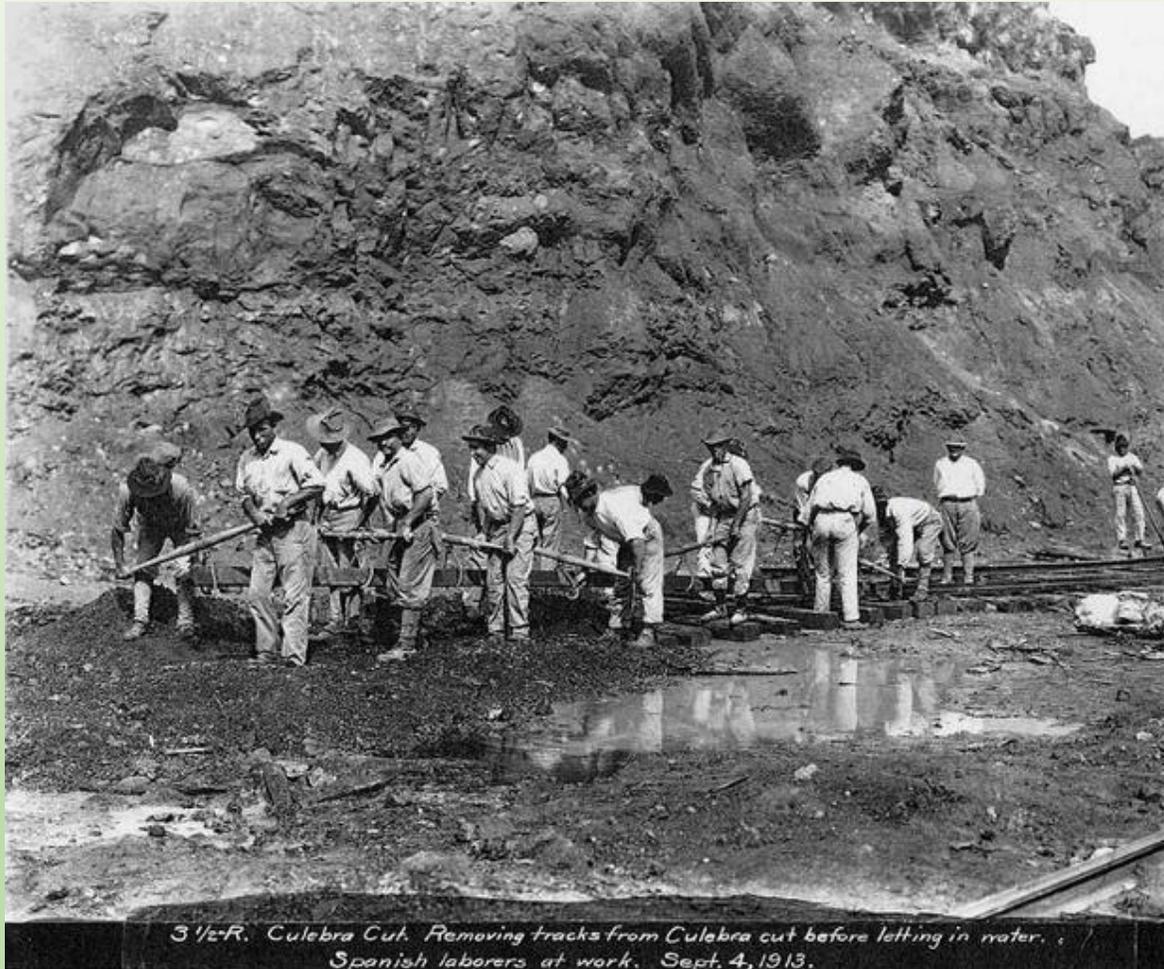


*Culex pipiens*





In the Panama jungle, standing water was always a problem.



*3 1/2-R. Culebra Cut. Removing tracks from Culebra cut before letting in water. Spanish laborers at work. Sept. 4, 1913.*

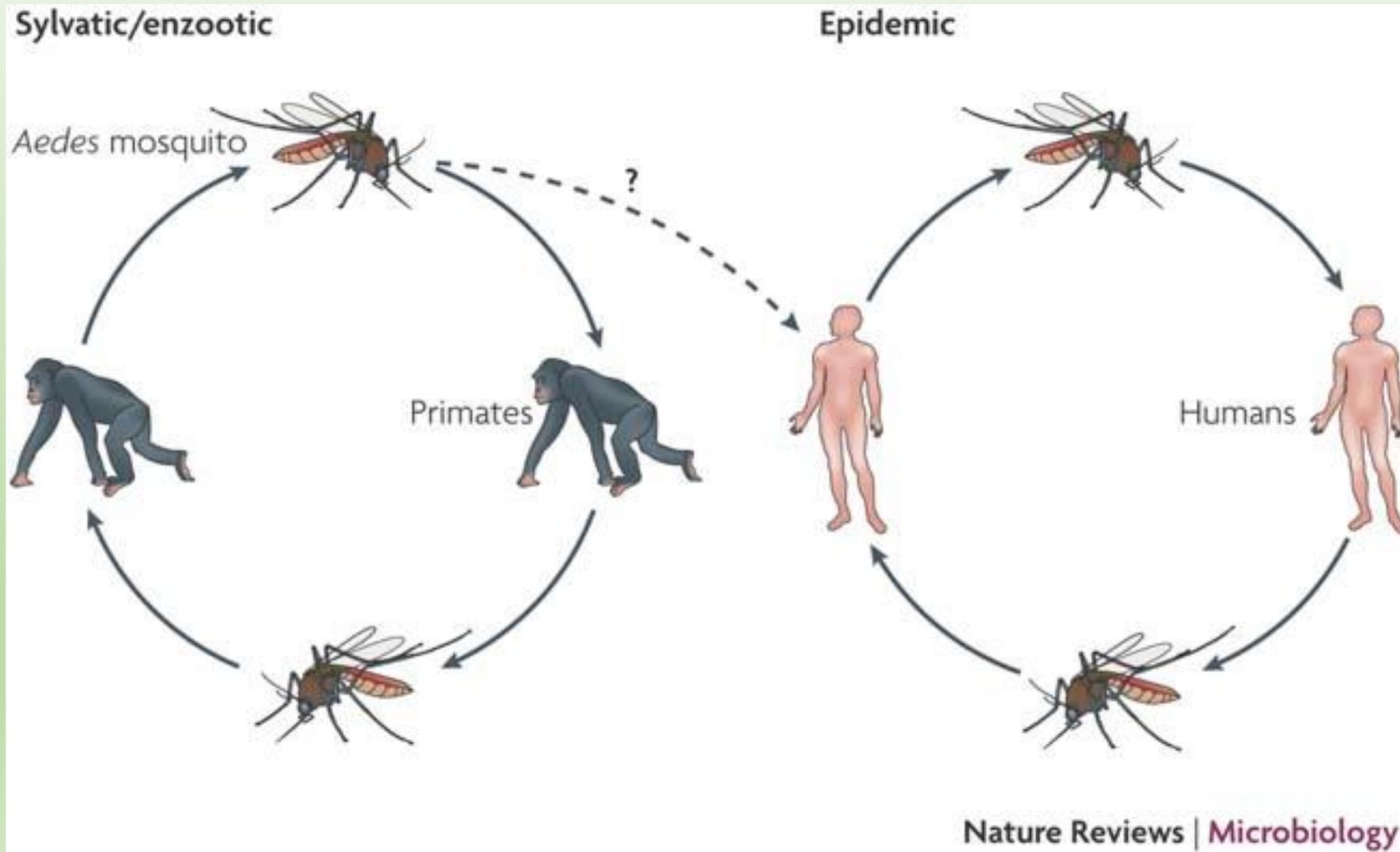


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Spreading oil with a mule-drawn cart in Panama, an effective way to eliminate mosquito larvae.

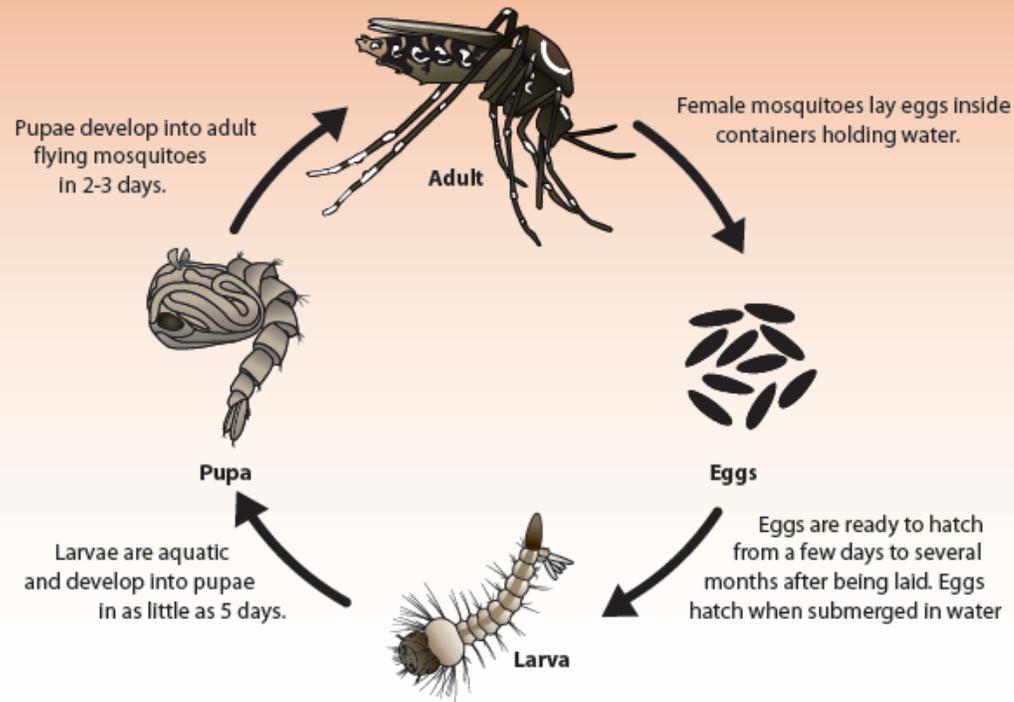


# Why can't the vaccine eliminate the disease?



# Mosquito life cycle

## *Aedes aegypti*



The *Aedes* mosquitoes have 4 life stages: egg, larva, pupa and adult. Mosquitoes can live and reproduce inside and outside the home. The entire life cycle, from an egg to an adult, takes approximately 8-10 days.

# LES MOUSTIQUES

.. CYCLE DE REPRODUCTION DE L'AEDES AEGYPTI ..



Other diseases spread by the YF mosquito



# *Aedes aegypti* Distribution

1970



1997



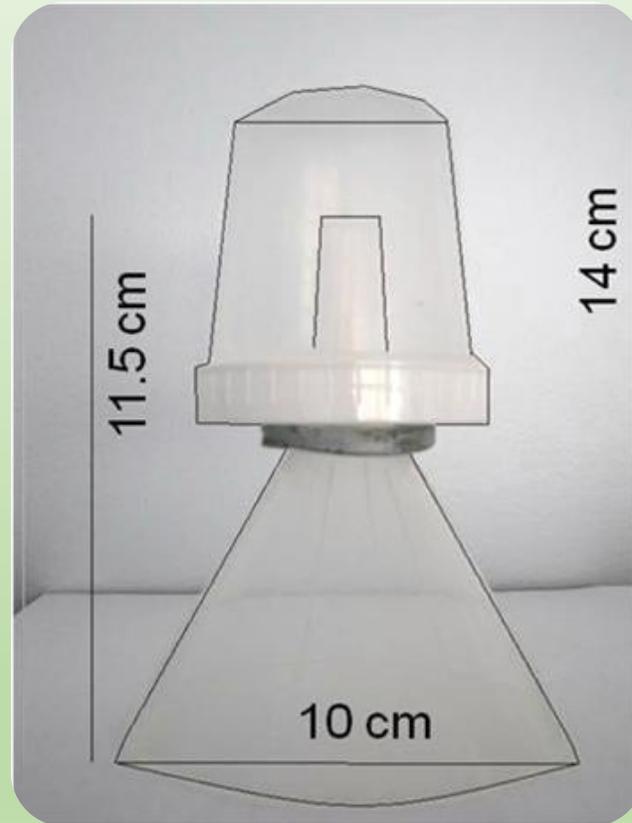
# Why did dengue return to the Western Hemisphere?

- **1. Declining vector control with return of large vector populations**
- 2. Unreliable water systems and need to keep containers on the roof, which provided larval development sites.
- 3. Increased use of plastic containers that did not biodegrade, collected water, and provided more larval development sites.
- 4. Increased air travel
- 5. Increasing human population in urban areas.



# Funnel Trap Calibration

- Miniaturized funnel trap
- 3<sup>rd</sup> and 4<sup>th</sup> instar larvae trapped from 1.5 m pools
- Four different larval population densities
- Regression plot of trap catch as a function of larval density

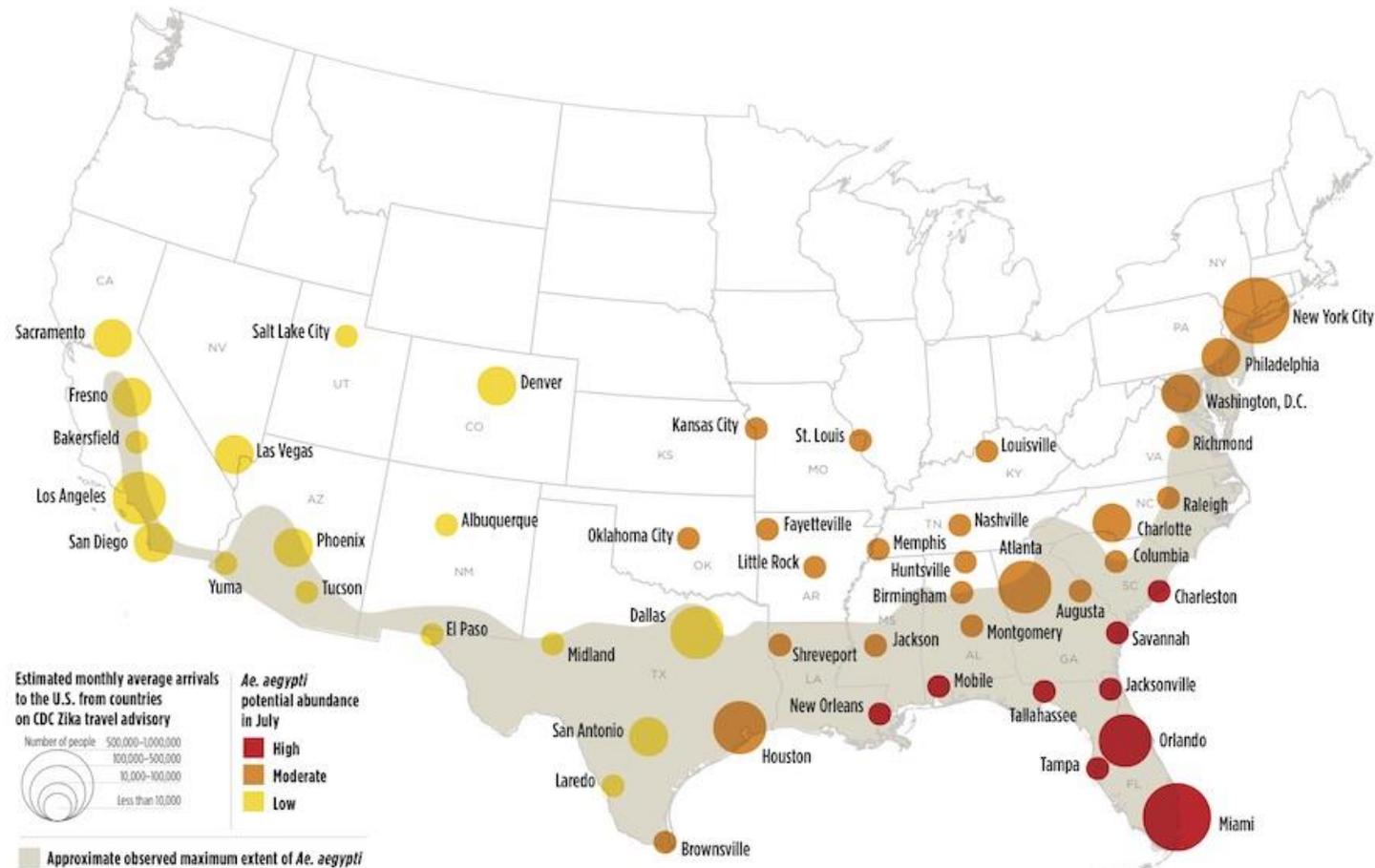




# Septic Tank Trap Results

	Present (%)	Mean daily trap count	95% CI	Range
<i>Aedes aegypti</i>				
Larvae (n = 89)	16 (17.98)	10.28	9.51 – 11.10	0.25 – 86.75
Adults (n = 93)	46 (49.46)	8.67	8.18 – 9.17	0.33 – 85.00
<i>Culex quinquefasciatus</i>				
Larvae (n = 89)	66 (74.16)	130.11	128.73 – 131.51	0.25 – 1,517.25
Adults (n = 93)	90 (96.77)	156.37	154.88 – 157.88	0.33 – 2,267.67

Cities at risk of Zika transmission as estimated by National Center for Atmospheric research (2016): Analysis based on measures of climate, mosquito breeding patterns, poverty and air travel trends.



# Preliminary findings of *Aedes* survey in Missouri

- To date, no *Aedes aegypti* (YF mosquito) have been found in the state.
- The Asian tiger mosquito is numerous and wide-spread across the state.
- The Asian rock pool mosquito is also wide spread and, in some places, very numerous.
- Auto salvage yards are a GREAT place to find all 3 species.



# So, is this an emergency?

- There is no evidence that the virus is in the mosquito population; however, there are healthy populations of what may be 2<sup>o</sup> vectors in the state.
- If it makes it into the mosquito population, it may become a public relations disaster, but it is unlikely that a large number of persons will be directly affected. To those who are, the effects can be devastating.
- If it becomes an emergency, it is of the “slowly developing” type.
- If public health actions become required, they should be based on surveillance of both the virus and the vector. Blanket applications of insecticides may serve some public relations benefits but do not serve to reduce disease risk very much.
- Actions should focus on hygiene (sanitation), public education, and targeted application of appropriate control measures in places known to harbor large vector populations such as abandoned real estate and large piles of tires.

# Focus on sanitation in high risk areas



# Questions?



- Contact information:

David Claborn

Interim director

MPH program

Missouri State University

901 South National Ave

Springfield, MO 65897

417-836-8945

[davidclaborn@missouristate.edu](mailto:davidclaborn@missouristate.edu)